ensia The National School of Artificial Intelligence المدرسة الوطنية العليا للذكاء الاصطناعي

2nd Year /Semester 3 (2024-2025)

Data Structures & Algorithms 2
Lab 7 Sorting

Exercise 1

1- Read and understand the provided implementation of insertion sort.
2- Run insertion sort on the input 3, 1, 4, 1, 5, 9, 2, 6, 5.
3- What is the running time of insertion sort if all elements are equal?

Exercise 2

1- Read and understand the provided implementation of merge sort.
2- Run merge sort on the input 3, 1, 4, 1, 5, 9, 2, 6.
3- Determine the running time of merge sort for sorted, reverse-ordered, and random input.
4- How would you implement merge sort without using recursion?

Exercise 3

1. Read and understand the provided implementation of quick sort.
2. Determine the running time of quicksort for sorted, reverse-ordered, and random input.

Exercise 4

1- Read and understand the provided implementation of heap sort.
2- Run heap sort on the input 142, 543, 123, 65, 453, 879, 572, 434, 111, 242, 811, 102.
3- Rewrite heap sort so that it sorts only items that are in the range Low to High, which are passed as additional parameters.

Exercise 5

Write a program to compare the execution time of the following sorting algorithms:

1. Bubble sort 2. Selection sort 3. Counting sort
4. Insertion sort 5. Heap sort 6. Merge sort
7. Quick sort

You should compare the algorithms for an increasing size of an input array N (1000, 10000,100000, etc.) and draw the corresponding graph for sorted, reverse-order, and random input.

• What do you notice when comparing the execution time with the asymptotic complexity of the different algorithms?
• What is your conclusion if you are asked to answer which algorithm is the fastest among quicksort, heap sort, and merge sort?